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Research Article

Cephalometric Determination of the Occlusal Plane According to the Sagittal Shift (Skeletal Class I, II and III)

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Abstract

Objective: The correct orientation of the occlusal plane is one of the most explicit criteria for an ideal prosthetic reconstruction. The aim of this work is to seek a correlation between the occlusal plane and the other craniofacial planes (Camper, Frankfort, axio-orbital, palatal and mandibular planes) from the angulations on teleradiographies of a population of Casablanca according to the different sagittal shifts (skeletal class I, II and III)

Materials and Methods: Our sample consisted of 374 patients, free of any anomaly and non-benefiting from a previous orthodontic treatment. The sample was divided into 3 groups, according to sagittal shift, after calculating their ANB: 159 skeletal class I, 163 skeletal class II and 52 skeletal class III cases.

Results: For POPM angle, a mean value of 20.4742° was found, it is 18.619° for class I cases, 22.279° for class II cases and 20.490° for class III cases. The POPP angle averages 12.9337°, it varies in 11.355° for class I cases, 14.009° for class II cases and 10.596° for class III cases. For the POPAO angle, it was found that the average value is 13.2719° for the whole sample, while for the three skeletal classes namely class I, class II and class III, it is 13.270°, 12.911°, 13.096° respectively. The OP and the camper plane make an angle of average 9.9782°, this angle is of average 13.270° for class I cases, 8.767° for class II cases and 9.798° for class III skeletal cases. The angle established between the PO and Frankfort plane is on average 8.675° in the Moroccan population, for class I it is 8.597°, while it is 8.240° for class II and 9.538° for class III.

Discussion: The comparison between the means of the different skeletal classes in our sample showed a significant difference between skeletal class I and class II, for POPC, POPM and POPP angles as well as a significant difference for POPM angle between class I and class III.

However, comparison of our study with other studies by different authors with the same objective and sampling as ours revealed a significant difference.

Conclusion: The orientation of the occlusal plane in relation to the craniofacial planes, mentioned above, according to the sagittal shift, gave us averages that allowed the practitioner to reconstruct the lost occlusion of the patient in a way close to his anterior occlusion, while taking into consideration his skeletal class, especially if it is a skeletal class II that revealed a significant difference compared to the other classes

Keywords: *Cephalometric Determination; Occlusal Plane; Sagittal Shift; Skeletal Class I, II and III*

Introduction

With tooth loss, the smile becomes severely compromised and unpleasant, hence the role of the dentist in restoring the patient's natural appearance, function and lost smile, through prosthetic rehabilitations meeting different criteria [1].

The correct orientation of the occlusal plane is one of the most explicit criteria for an ideal prosthetic reconstruction, a reproduction of an optimal occlusion close to the patient's previous occlusion.

The occlusal plane has been defined, according to Glossary: the average plane established by the incisal and occlusal surfaces of the teeth. In general, it is not a plane but the planar average of the curvature of these surfaces [2].

The specifically formed occlusal complex becomes the foundation for the normal basic functioning of the stomatognathic system, especially for the functions of mastication and articulation. Most studies concerning the establishment of an artificial occlusal plane in edentulous patients advocate the placement of artificial teeth in a natural position [1].

Various methods have been described for reproducing the occlusal plane such as the anatomical, physio-functional and radiological method.

The cephalometric study is a radiological method that relies on the measurement of cranial skeletal landmarks using lateral view radiographs of the head. It is a technique that uses reliable, non-absorbable hard tissue craniofacial structures. Cephalometry has been declared as the useful tool to evaluate the outcome of prosthetic rehabilitation [3].

Objective of the Study

The objective of our work is to seek a correlation between the occlusal plane and the other craniofacial planes (Camper's plane, Frankfort's plane, axio-orbital plane, palatal plane and mandibular plane) from angulations on teleradiographies of a Casablanca population according to the different sagittal offsets (skeletal class I, II and III).

Materials and Methods

Our work is a descriptive cross-sectional epidemiological study carried out in the CHU IBN ROCHD dental consultation and treatment center, dentofacial orthopedics department and in private orthodontic practices in Casablanca. The study was spread over three months (between February and April 2022).

The patients selected were subjects, young adults or adults with a complete permanent dentition in the absence of any previous or ongoing orthodontic and/or orthopedic treatment. Cleft cases and patients with prior surgery were excluded.

Any non-operable profile teleradiography was eliminated from the study.

347 patients were selected from the target population and therefore 347 profile teleradiographs were used for our study.

For the collection of the data necessary for our study, we made information sheets that include the number of the sheet, the ANB angle, the skeletal class whose classification was based on the value of the ANB angle as well as all the angular measurements of the case.

The cephalometric tracing of the occlusal plan and the different craniofacial planes was performed with a 0.5 mm criterium pencil on a GODATRACE tracing paper attached to the film and placed on a negatoscope by a single experienced orthodontist. According to the standard technique, the subject's profile is turned to the right and the X-ray is oriented so that the SN line (Nasion-geometric middle of the sella turcica) is horizontal.

For each radiological image, we first located the essential points for the drawing of the planes, namely: upper point of the acoustic meatus, condylar point, sub-nasal point, infra-orbital point, anterior nasal spine, posterior nasal spine, free edge of the mandibular central incisors and the disto-vestibular cusp of the mandibular 2nd molars (Table 1).

Cephalometric point	Definition
Superior point of the acoustic meatus	Superior point of the external auditory canal
Condylar point	The center of the condylar process
Subnasal point	Most anterior point of the nasofrontal suture. If the suture is still open, take the upper point, at the level of the frontal
Infraorbital point	Inferior point of the orbital image
Anterior nasal spine	Most anterior point of the anterior nasal spine, at the tip of the secondary palate
Posterior nasal spine	At the tip of the secondary palate
Free edge of the mandibular central incisors	The upper point of the free edge of the mandibular central incisors
The disto-vestibular cusp of the mandibular 2nd molars	The most sloping point of the disto-vestibular cusp of the mandibular 2nd molars.

Table 1: *Cephalometric points studied and their definitions.*

Afterwards, the six planes were traced: occlusal plane, Frankfort plane, camper plane, axio-orbital plane, palatal plane and mandibular plane (Figure 1).

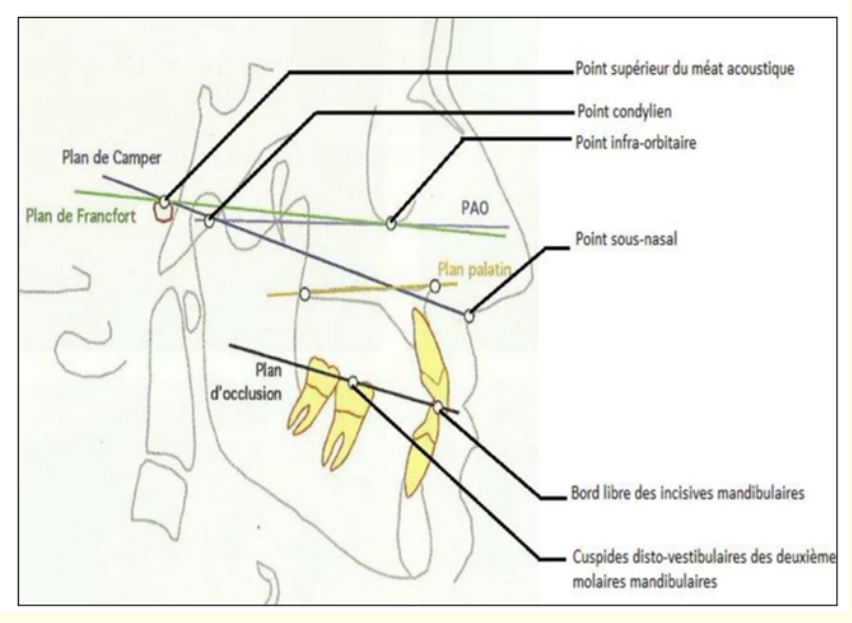

Figure 1: *Plot showing the various craniofacial planes studied.*

Finally, angular measurements were made using the same protractor of the angles between the PO and the Frankfort plane (POPF), the PO and the Axio-orbital plane (POPAO), the PO and the Camper plane (POPC), the PO and the Palatine plane (POPP) and then between the PO and the Mandibular plane (POPM).

The means of the angulations of the global sample and the 3 groups with the standard deviations were determined for the comparison between the means of the sample on the one hand and the comparison of the means of our study with those of the other studies on the other hand by using the Student's statistical test ($p < 0.05$).

Results

The measurement of the ANB angle made it possible to divide our sample of 347 teleradiographies analyzed into 3 groups: Group 1 comprising 159 Class I cases, i.e., 42% of the sample, Group 2 comprising 163 Class II cases, 44% of the cases, and Group 3 comprising 52 Class III cases, which represents 14% of the subjects (See figure 2).

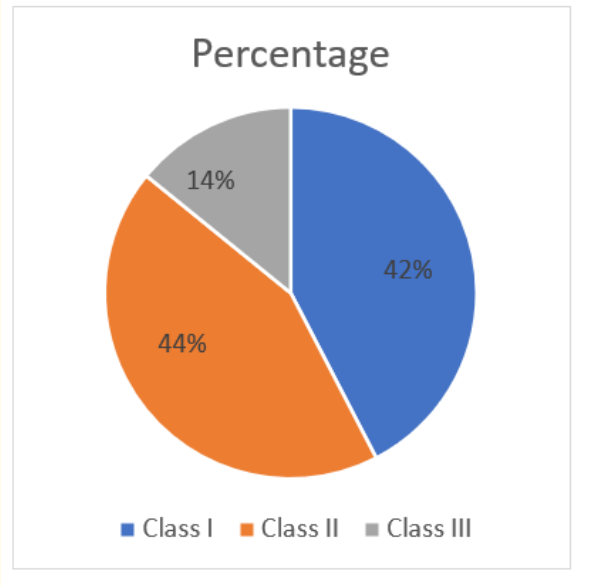

Figure 2: *Distribution of the sample according to skeletal class.*

Table 2-4 show the results of the angular measurements made for each group. In addition, table 5 shows the overall results of the average angular measurements of the whole sample.

	POPM	POPP	POPC	POPF	POPAO
Mean	18,619	11,355	10,723	8,597	13,270
SD	5,0511	3,6118	3,8786	2,9833	3,5354

Table 2: *Results of angular measurements of group 1: Skeletal class I.*

	POPM	POPP	POPF	POPC	POPAO
Mean	22,279	14,009	8,240	5,767	12,911
SD	4,0048	4,4519	3,7977	3,2262	4,5684

Table 3: *Results of angular measurements of group 2: Skeletal class II.*

	POPM	POPP	POPF	POPC	POPAO
Mean	20,490	10,596	9,538	9,798	13,096
SD	2,6980	4,5536	3,7349	3,9770	5,3248

Table 4: *Results of angular measurements of group 3: Class III skeletal.*

	POPM	POPP	POPF	POPC	POPAO
Mean	20,4742	12.9337	8.675	9,0782	13,2719
SD	4.4315	4,0668	3,4768	3,5336	4,2160

Table 5: *Overall results of angular measurements of the whole sample.*

Statistical comparison between class I and class II gave the following values for POPM POPC and POPP angle, the p-value was less than 10 to the -5 power, otherwise for POPF angle the p-value was 0.34 and finally for POPAO the value was 0.43 (Table 6).

	Classe I = 159 Mean (SD)	Classe II = 163 Mean (SD)	P value
POPM	18,619/25,514	22,279/16,038	<0,00001
POPP	11,355/13,045	14,009/19,819	<0,00001
POPF	8,597/8,900	8,240/14,423	0,349
POPC	10,723/15,043	5,767/10,408	<0,00001
POPAO	13,270/12,499	12,911/20,870	0,431

Table 6: *Comparison of sample values from class I to class II values.*

Statistical comparison between class I and class III gave the following values: for POPP angle (p = 0.22) for POPF (p = 0.06), then POPC (p = 0.13), for POPAO (p = 0.78), and finally POPM (p = 0.011) (Table 7).

	Classe I=159 Mean (SD)	Classe III=52 Mean (SD)	P value
POPM	18,619/25,514	20,490/7,279	0,011
POPP	11,355/13,045	10,596/20,736	0,220
POPF	8,597/8,900	9,538/13,949	0,065
POPC	10,723/15,043	9,798/15,816	0,139
POPAO	13,270/12,499	13,096/28,353	0,788

Table 7: *Comparative table of sample values from class I to class III values.*

Discussion

The plane of occlusion has been recognized as an essential element that ensures the function of the craniofacial skeleton. However, its determination is subject to subjective variations. Various authors have advocated the use of different landmarks for its determination. Concerning the orientation of the occlusal plane in relation to the anatomical landmarks. Zarb., *et al*. [4] recommended that the occlusal plane should remain parallel to the inter-pupillary line.

Contrary to the findings of Gupta., *et al*. who observed such parallelism in only 13% of subjects [5] and also Jain., *et al*. who found 20% of subjects with such parallelism in their study [6].

Mehwish's study showed that the OP coincides with the lower third of the CRM retro-molar pad in 50% of the subjects [7].

Yasaki [8], Nagle and Sears [9] suggested that the occlusal plane should be oriented at the same level as the lateral border of the tongue, in order to embody the theory that food is controlled on the occlusal table by the tongue.

A study by Ghosn., *et al*. [10] on neutral zone casts using phonation showed that the ala-tragus line extending from the lower edge of the nasal ala to the lower edge of the tragus had the closest relationship to the prosthetic occlusal plane corresponding to the lateral edges of the tongue.

In another study, Lunquist and Luther [11] observed that the commissures ranged from 1 to 3 mm either superiorly or inferiorly to the occlusal plane. Although Shigli., *et al*. [12] deduced that the lip commissure was lower than the occlusal plane is 1.37 mm. The decision to rely on the corner of the lip as a guide for orientation of the occlusal plane is not reliable, because with age, the corners of the mouth collapse or fold.

Gupta., *et al*. [5] concluded that for 70% of men and 66% of women, the occlusal plane was at the same level as the buccinator sulcus and could be used as a reliable landmark for OP orientation. The buccinator sulcus can only be a reliable landmark in patients with good muscle tone, because aging leads to a progressive loss of muscle tone.

Foley and Latta [13] used the parotid papilla as a reference guide for orientation of the occlusal plane. They examined dentate patients to determine the distance between the occlusal plane and the inferior margin of the right and left parotid papillae. They found that the parotid papilla was 3.3 mm above the OP.

The studies cited above show that there is a wide disparity in the position of the parotid papilla, ranging from 2.56 mm to 6 mm, above the occlusal plane in dentate subjects. Therefore, this landmark alone is not an accurate guide for PO orientation.

In the context of anatomical location of the occlusal plane, Gysi [14] concluded that the occlusal plane should follow the curve of the mandibular ridge for perpendicular transmission of masticatory forces to the ridge. Cocker and Ackerman [15] confirmed the above result. However, Walker [16] believes that the OP is parallel to the maxillary ridge.

Most of the works dealing with the problem of determining the occlusal plane in a joint prosthesis use the flag technique, which is a geometric method based on Monson's theory [17]: the upper teeth move on the surface of the antagonist teeth as if they were on the surface of a sphere that had the CRISTA GALLI apophysis as its center with a fixed radius of 104mm.

Regarding the so-called physiological methods, Klein, since 1970, developed a printing technique called piezography. Its principle was to model muscle activity using a plastic material. This technique makes it possible to determine an "equilibrium zone" in which the prosthesis must be made to obtain maximum stability and to propose an occlusion plan. Indeed, this concept offers the determination of the occlusal plane located on the upper limit of the mandibular prosthetic corridor, this corridor corresponds to the part of the tongue, this technique is allowed by pronouncing the phoneme SIS [18]. Also the Paterson method [19] is based on the physiological and functional

recording of the occlusal plane to obtain an individualized plan for the patient. Indeed, this method involves the patient by performing a mandibular movement (lateral and protrusion).

As far as cephalometric methods are concerned, for Delaire [20], the occlusal plane corresponds to the occipito-occlusal line: it is a line close to the bisector of the angle between the cranio-palatal line and the occipito-mandibular line, passing through the occipito-mandibular point to the middle of the ENA-chin segment. Posteriorly, this line is tangent to the occlusal plane of the 1st permanent molars. Anteriorly, it is adjacent to the upper incisal edge after cutting the crown of the lower incisors.

In prosthetics, Ricketts' Xi point is used as a posterior determinant in prosthetic bite line reconstruction. According to Ricketts [21], the occlusal plane passes above the Xi point at 8 years, through the Xi point at 10 years, and slightly above it at 12 years. Le joyeux [22] states that the plane of occlusion passes through point Xi posteriorly and 22 mm above the free edge of the lower incisors anteriorly. This technique is indicated in total and partial dentures with class 1 Kennedy bimaxillary edentulous cases.

In addition, Sassouni [23] adopted a typological method that does not require angular values: he studied on 2 different teleradiographs; one from the front and the other from the side, the facial structures in relation to arcs of circles centered on a point, this point is the center of convergence of a plane tangent to the base of the skull, the palatal plane, PO and the mandibular plane. The occlusal plane runs from the middle of the incisal overlap to the middle of the first molar overlap and should normally converge to the 0 point.

In the literature, we found some studies with the same objective and the same sampling as those of our work. Beginning with Sinobad, which performed a cephalometric study to determine the inclination of the occlusal plane in dentate subjects with different skeletal relationships between the jaws (Angle Class I, II and III) with the aim of finding more reliable guides for establishing the occlusal plane in edentulous patients [24].

Next is Lahori and colleagues who adopted the same classification in 2012 to study the relationship between the occlusal plane and Camper's lines in a sample of 60 cases [25].

Ow also studied the inclination of the occlusal plane in relation to other craniofacial planes according to different skeletal relationships on a sample of 28 Chinese dentate patients [26].

In the study by Sahoo., *et al*. he showed the numerous works done in the literature on the relation of the occlusal plane to the anatomical reference planes in dentate and edentulous subjects in the Angle Class I, Angle Class II, and Angle Class III maxillomandibular relationship [1].

The majority of studies have shown that the Frankfurt plane (FH) is a reliable skeletal landmark while the Camper plane is a reliable clinical landmark for establishing a lost occlusal plane in edentulous subjects with different Angle maxillo-mandibular relationships. However, this study found that the following planes, namely Camper's plane, FH plane, and PL plane, are sound guides for establishing the occlusal plane. Therefore, the use of Camper's plane as a landmark for the establishment of the occlusal plane, as well as the transfer of the FH plane through the facebow will serve as a definitive guide for the establishment of the occlusal plane.

Then, in 2013, Kumar., *et al*. conducted their study on the reliability of anatomical reference planes in establishing the occlusal plane in different arch relationships. Their work was on a total of 180 cases divided into 4 groups: groups 1 and 2 include young subjects consisting of fully edentulous subjects with class I and II skeletal relationship While in group 3 and group 4, the subjects were fully edentulous with class I and class II skeletal jaw relationship [27]. This same classification was adopted by Shergil with a sample of 100 cases [28].

In the study by Nikita Sinha., *et al*. cephalometry was used to aid in the determination of occlusal plane orientation using nonabsorbable anatomical landmarks in skeletal Class II participants in a sample of 100 dentate patients [3].

However, other studies were found in the literature that had the same objective as our work, but with different sampling: their studies were based on classification according to vertical direction.

In 2000, Seifert., *et al*. worked on a total of 60 Class I cases to determine cephalometric parameters for occlusal plane reconstruction in oral rehabilitations [29].

Then Gandhi., *et al*. had conducted a study in 2017 on 100 Class I cases on the relationship between the occlusal plane and the Ala-tragus line [30].

Then in 2021, a study conducted on 160 case in Morocco of skeletal class I for the determination of the relationship of the occlusal plane and the other craniofacial planes classified according to the vertical shift (normo divergent, hypo divergent and hyper divergent) [31].

In 2016, Subhas., *et al*. conducted a study on 75 patients classified according to head shape, divided into 3 groups: mesiocephalic, dolicocephalic, and brachycephalic shapes in order to find the relationship between the occlusion plane and the three ala-tragal lines [32].

All of these studies have a smaller sample size than ours.

Class III cases are significantly lower compared to class II, this is due to the predominance of class II shift in the Moroccan population according to a study conducted by Ousehal., *et al*.

For class I, the POPC angle has a mean value of 10.723 in the Moroccan population. While for the Indian population Lahori [25] reported a mean value of 6.5 and Kumar [27] revealed a value of 7.05. However, Ow [26] noted a value of 10 in a Chinese population.

Statistical comparison showed significant differences for the POPC angle with the Indian population.

For the POPF angle, a mean value of 8.597 was noted in the Moroccan population. Ow [26] found a value of 9.8 for a Chinese population. And Kumar [27] found a value of 10.6 in the Indian population.

Statistical comparison showed significant differences for the POPF angle with the Indian population.

For the POPP angle, a mean value of 11.355 was found in the Moroccan population, and Kumar [27] found a value of 6.00 in the Indian population.

The statistical comparison did not show significant differences for the POPP angle with the study population.

For the POPM angle, a mean value of 18.619 was found in the Moroccan population, while Kumar [27] found a value of 16.15 in the Indian population.

Statistical comparison showed significant differences for the POPM angle with the Indian population.

For class II, we found a mean value of 5.67° for the POPC angle in the Moroccan population. For an Indian population Lahori [25] reported a mean value of 6.65° and Kumar [27] imported a value of 7.65°while Ow [26] noted a value of 6.4° in a Chinese population.

Statistical comparison showed significant differences for the POPC angle with the Indian population.

For the POPF angle, a mean value of 8.240° was noted in the Moroccan population. Ow [26] found a value of 13.5° for a Chinese population and Kumar [27] noted a value of 12.05° for an Indian population.

Statistical comparison showed significant differences for the POPF angle with the Indian and Chinese populations.

For the POPP angle, a mean value of 14.006° was noted in the Moroccan population. While Kumar [27] deduced a value of 7.15° for an Indian population.

The statistical comparison showed significant differences for the POPP angle with the Indian population.

For the POPM angle, a mean value of 22.279° was noted in a Moroccan population. However, Kumar [27] found a value of 20.65° for an Indian population.

Statistical comparison showed significant differences for the POPM angle with the Indian population.

Regarding class III, for the POPC angle, a mean value of 9.798 was noted in the Moroccan population. Lahori [25] reported a mean value of 8.200 in the Indian population and then Ow [26] noted a value of 8.6 in a Chinese population.

Statistical comparison of the means of the class III sample with those found by other authors on various populations did not show significant differences.

For the POPF angle, a mean value of 9.538 was noted in a Moroccan population. While Ow [26] deduced a value of 12.3 for a Chinese population.

The statistical comparison did not show significant differences for the POPF angle with the different populations.

We also conducted a statistical comparison between the different classes in our study.

The statistical comparison between class I and class II showed very significant differences for the POPM angle, POPC angle and POPP angle. The POPP and POPM angles had higher values compared to the Class I sample values. While the POPC angle value was lower compared to the Class I sample value. Nevertheless the comparison was non-significant for POPF and POPAO angles.

The statistical comparison between class I and class III did not show a significant difference for the angles: POPP POPF POPC POPAO the only significant difference was noted for the angle POPM.

The value of POPM angle in case III was higher in comparison with that of class I.

Conclusion

The orientation of the occlusal plane in relation to the craniofacial planes according to the sagittal shift (skeletal classes I, II and III), granted us averages that will allow the practitioner to reconstruct the patient's lost occlusion in a way that is close to his anterior occlusion, while taking into consideration his origins as well as his skeletal class, especially if it is a skeletal class II which revealed a significant difference compared to the other classes.

Further studies should be conducted in the future studying the different planes to strengthen our results and to use these values in the determination of the occlusal plane of patients who have lost all occlusal reference.

Bibliography

1. Kumar P., *et al*. "Systematic assessment of the various controversies, difficulties, and current trends in the reestablishment of the lost occlusal planes in edentulous patients". *Annales De La Recherche En Sciences Médicales Et De La Santé* (2014): 3.

2. Keith J Ferro. "The glossary of prosthodontic terms: Ninth Edition". *The Journal of Prosthetic Dentistry* 117.5 (2017): e1-e105.

3. Sinha N., *et al*. "A cephalometric analysis of Class II dentate subjects to establish a formula to determine the occlusal plane in Class II edentate subjects". *The Journal of Indian Prosthodontic Society* 17.3 (2017): 226-232.

4. Zarb G. "Treatment for edentulous patients, Boucher's prosthodontic, 10th edition". CV Mosby, St. Louis (1998): 296-309.

5. Gupta R., *et al*. "Relationship of anatomic landmarks with occlusal plane". *The Journal of Indian Prosthodontic Society* 9 (2009): 142-147.

6. Kumar P., *et al*. "Reliability of anatomic reference planes in establishing the occlusal plane indifferent jaw relationships: a cephalometric study". *Indian Prosthodontic Society* 13.4 (2012): 571-577.

7. Mehwish Khan., *et al*. "Relationship of natural occlusal plane with different anatomical landmarks". *Journal of Pakistan Medical Association* 71.3 (2021): 863-867.

8. Yasaki M. "Height of the occlusion rim and the interocclusal distance". *The Journal of Prosthetic Dentistry* 11 (1961): 26-31.

9. Nagle RJ and Ears VH. "Denture prosthetics 2". St. Louis: The C. V. Mosby Company (1962): 134.

10. Abi-Ghosn C and Makzoumé JE. "Relationship between the Occlusal Plane corresponding to the Lateral Borders of the Tongue and Ala-tragus Line in Edentulous Patients". *The Journal of Contemporary Dental Practice* 13.5 (2012): 590-594.

11. Lundquist DO and Luther WW. "Occlusal plane determination". *Journal of Prosthetic Dentistry* 23 (1970): 489-498.

12. Shigli K., *et al*. "Validity of soft tissue landmarks in determining the occlusal plane". *The Journal of Indian Prosthodontic Society* 5 (2005): 139-145.

13. Foley PF and Latta GH. "Study of the position of the parotid papilla relative to the occlusal plane". *The Journal of Prosthetic Dentistry* 53 (1985): 124.

14. Schittly J. "Quelle position mandibulaire pour quelle occlusion en prothèse amovible partielle". Paris, Comptes rendus CNO (1997).

15. Santure Hebrad JP. "Occlusion, schémas occlusaux et orientation du plan d'occlusion en prothèse dentaire". Thèse (1997).

16. Santure Hebrad JP. "Occlusion, schémas occlusaux et orientation du plan d'occlusion en prothèse dentaire". Thèse (1997).

17. De Praeter J., *et al*. "Long-term stability of the leveling of the curve of Spee". *American Journal of Orthodontics and Dentofacial Orthopedics* 121.3 (2002): 266-272.

18. Genin G. "L'orientation du plan d'occlusion mandibulaire en prothèse amovible complète: de la complexité à la pratique quotidienne". *Sciences du Vivant* (2012).

19. El Aoud J., *et al*. "Determination of the Occlusal Plane in Complete Denture: About the Paterson Technic". *Integrative Journal of Medical Sciences* 8 (2021): 488.

20. Delaire JS and Alagnac JK. "Motarif Diagnostic des dysmorphoses dento-maxillo-faciales; apport de l'analyse architecturale informatisée Actaodontol (1994).

21. Ricketts RM. "Cephalometric analysis and synthesis". *The Angle Orthodontist* 31 (1961): 141-156.

22. Lejoyeux J. "Prothése complete". Paris: Maloine (1986).

23. Rupple L. "An apparatus to determine the position of the occlusal plane in prosthetic and orthodontic cases". *Q. Record* 40 (1920): 637-639.

24. Sinobad D. "The position of the occlusal plane in dentulous subjects with various skeletal jaw-relationships". *Journal of Oral Rehabilitation* 15 (1988): 489-498.

25. Lahori M., *et al*. "A cephalometric study on the relationship between the occlusal plane, ala tragus and camper's lines in subjects with angles's class1, class 2 and class 3 occlusion". *The Journal of Indian Prosthodontic Society* 13.4 (2013): 494-498.

26. OW RKK., *et al*. "The relationships of upper facial proportions and the plane of occlusion to anatomic reference". *The Journal of Prosthetic Dentistry* 61.6 (1989): 727-733.

27. Kumar P., *et al*. "Reliability of anatomic reference planes in establishing the occlusal plane indifferent jaw relationships: a cephalometric study". *Indian Prosthodontic Society* 13.4 (2012): 571-577.

28. Shergil Dk. "Evaluation complexes de la cohérence des différents plans de référence lors de la réorientation du plan occlusal dans les relations des mâchoires de classe 1 et de classe 2: une étude céphalométrique in vivo". Rev Int de recherche en santé et sciences connexes 4.2 (2018).

29. Seifert D., *et al*. Relations des plans de référence pour l'orientation du plan prothétique Acta Stomat Croat 4.4 (2000).

30. Gandhi N., *et al*. "Cephalometric study of the position of ala-tragus line in relation to Frankfort horizontal plane and occlusal plane among Ludhiana population". *Indian Journal of Dental Sciences* 9 (2017): 165-169.

31. Alfidi Jamila Ait Ben Bouazza Khadija. "Etude de la relation entre le plan d'occlusion et les divers plans craniofaciaux a partir des traces céphalométriques d'une population casablancaise". Thèse (2022).

32. Subhas S., *et al*. "A cephalometric study to establish the relationship of the occlusal plane to the three different alatragal lines and the Frankfort horizontal plane in different head forms". *Journal of Stomatology, Oral and Maxillofacial Surgery* 118.2 (2017): 73-77.

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